

Sequence VIII Bearing Task Force Conference Call Minutes

Date: February 5, 2016

Prepared by: Patrick Lang

Members Present:

Clayton Knight, Dan Lanctot/TEI

Gordon Farnsworth, Andy Ritchie/Infineum

Robert Stockwell/Oronite

Adrian Alfonso, Charlie Leverett/Intertek

Jerry Brys, Kevin O'Malley/Lubrizol

Ron Romano/Ford

Tim Caudill, Amol Savant/Valvoline

Tony Hendrix, Patrick Lang/SwRI

Rich Grundza/TMC

The task force was convened to create a list of ideas that could be considered as options to make adjustments on the next batch of bearings.

Dan Lanctot from TEI had a previous discussion with Paul at Federal Mogul to discuss the possible adjustments that could be entertained to increase the potential for success on the next batch of connecting rod bearings.

Dan reported the following information from his discussion with Paul:

- 1) Pilot Batch: It is possible to make a pilot batch but Paul advised that the sintering process is one of the variables. The line would be broken down for the next job until we determined if the pilot batch was ok. Having to set up the line again to do the final batch would be a variable in itself.
- 2) Powder Concentration: Paul advised that the powder can't be adjusted once it is made. So if the concentration is not correct the entire batch of powder has to be discarded.
- 3) Broaching: the current method of broaching is a very old process which is subject to lead pull-out (lead chunks being removed as opposed to being cleanly cut by the broach). The industry has now moved to a boring process which produces a more consistent bearing surface.

Chairman Lang referred the group to the following summary of powder concentrations that he provided from the previous batches:

Sequence VIII Powder Concentration Summary				
Batch ID	01-09	09-10	08-15	Spec %
Lead %	23.36	24.79	23.40	21 - 27
Tin %	0.94	1.05	0.98	0.6 - 1.25
Copper	Balance	Balance	Balance	Balance
Note: Table shows raw powder analysis by Federal Mogul				

Although the tin concentration in the actual powder for the 08-15 bearings as shown above is similar to the other batches, the SwRI SEM data of the bearing cross-section (presented during a previous conference call and shown again below) showed the 08-15 batch to have a lower tin concentration.

SEM Sample ID	1276	1277	1278	1272	1273	1274	2231	2232	2233
Bearing Batch	01-09 Batch	01-09 Batch	01-09 Batch	09-10 Batch	09-10 Batch	09-10 Batch	08-15 Batch	08-15 Batch	08-15 Batch
Copper, weight %	65.09	69.75	68.21	62.59	66.90	67.06	64.42	63.43	67.40
Lead, weight %	33.72	28.98	30.62	36.23	31.81	31.65	34.64	35.60	31.79
Tin, Weight %	1.19	1.28	1.17	1.19	1.29	1.29	0.94	0.97	0.81

Charlie Leverett commented that we should adjust the tin level in the new batch to be closer to the historic batches.

Gordon Farnsworth asked about the potential size of the granules in the powder mix and if their size would have any effect on the bearings.

Charlie Leverett asked about previous batches that were still made in the US. The group recalled that the previous batch designations of 03-06 and the 05-08 were made in the United States. During the Call Dan from TEI was able to locate the powder concentration for the 03-06 bearings. The concentrations are as follows:

Lead: 22.38%

Copper 76.55%

Tin: 1.06%

Iron: 0.01%

The following is a list of questions that the group came up with to ask Federal Mogul prior to the production of the next bearing batch:

- 1) Has the same vintage of powder been used over time or does the source of the elements used in the powder change over time, i.e., are supplier changes typical?

- 2) Is there any gauge on the purity of the elements in the powder?
- 3) Does the grain size of the powder matter and if so does it change the post-sintering distribution of the copper and lead?
- 4) Is it possible to rebore/rebroach bearings that have already been bored/broached? We are curious to see if we can 'resurface' the 08-15 bearings and see if they perform differently.
- 5) In older batch productions, we would change the broach after a predetermined number of cuts on that broach and that count would constitute a lot within a batch. At the time we were making a much larger batch but perhaps it would be worth changing the broach often on a smaller batch.
- 6) Would it be possible to prepare three different powder concentrations and use all three on the same bearing run? Specifically, just feed the three concentrations in succession with a distinct break or mark to identify the separation?
- 7) What is the minimum number of bearings halves that can be made in one production run?

Tim Caudill from Ashland stated that their lab still had some older bearings and asked the questions if their lab was allowed to calibrate on them. Chairman Lang commented that he released an official letter to the API deeming the Sequence VIII test unavailable because the two independent laboratories no longer had bearings to conduct tests. The questions was bounced around the group but it wasn't clear to any of the members present if a dependent lab could conduct calibration tests after the test has been officially deemed unavailable. Rich Grundza from the TMC recalled that there were written guidelines regarding the definition of a test being unavailable. Rich would distribute them to the group.

No decision was made during the conference call on allowing the dependent lab to calibrate on older bearings.

Action Items:

1. Determine the number of Sequence VIII runs that have been conducted in GF-5 to date to get an idea on the estimated number of bearings that would be needed for GF-6. This request is in the context of the group entertaining making a smaller batch size due to minimize losses if the new batch doesn't perform properly.
2. Gordon/Andy Ritchie to send historical notes from previous bearing batch manufacturing to the group (this was actually completed during the call).
3. Rich Grundza to distribute to the group the documentation regarding a test being unavailable.

The meeting was adjourned at 9:50 Central time. The next meeting will be at the call of the chairman.